CLAIMS

1. A method of reading a multilevel signal from an optical disc comprising:

reading a raw analog data signal from a disc using an optical detector;

preliminarily correcting for amplitude modulation in the analog data signal to obtain a preliminarily corrected analog data signal;

recovering a timing signal from the preliminarily corrected analog data signal; and

correcting for amplitude modulation of the raw analog data signal by processing the raw analog data signal and the timing signal.

2. A method of reading a multilevel signal from an optical disc as recited in claim 1 wherein correcting for amplitude modulation of the raw analog data signal includes evaluating the value of the raw analog data signal at times determined to correspond to gain control fields.

3. A method of reading a multilevel signal from an optical disc as recited in claim 1 wherein the times determined to correspond to gain control fields are determined using the recovered timing signal.

4. A method of reading a multilevel signal from an optical disc as recited in claim 3 wherein correcting for amplitude modulation of the raw analog data signal includes detecting an envelope of the raw analog data signal and normalizing the raw data signal.

5. A method of reading a multilevel signal from an optical disc as recited in claim 1 wherein using the timing signal to further correct for amplitude modulation in the amplitude adjusted analog data signal further includes normalizing the adjusted analog data signal based on the strength of the signal read at a gain control field.

6. A method of reading a multilevel signal from an optical disc as recited in claim 5 wherein normalizing the adjusted analog data signal based on the strength of the signal read at a gain control field includes detecting the strength of the signal at a point near the center of the gain control field and wherein the center of the gain control field is found using the timing signal.

7. A method of reading a multilevel signal from an optical disc comprising:

reading a raw analog data signal from a disc using an optical detector;

recovering a timing signal from the raw analog data signal;

converting the analog signal to a digital data signal using an A/D converter; and

correcting for amplitude modulation of the raw analog data signal by processing the digital data signal to obtain an amplitude adjusted digital data signal.

8. A method of reading a multilevel signal from an optical disc as recited in claim 7 wherein the timing signal is input to the A/D converter.

9. A method of reading a multilevel signal from an optical disc as recited in claim 7 wherein the amplitude of the raw analog data signal is adjusted before the timing signal is recovered.

10. A method of reading a multilevel signal from an optical disc comprising:

reading a raw analog data signal from a disc using an optical detector;

correcting for amplitude modulation of the raw analog data signal by processing the raw analog data signal to obtain an amplitude adjusted analog data signal;

recovering a timing signal from the amplitude adjusted analog data signal; and

using the timing signal to further correct for amplitude modulation in the amplitude adjusted analog data signal.

11. A method of reading a multilevel signal from an optical disc comprising:

reading a raw analog data signal from a disc using an optical detector;

correcting for amplitude modulation of the raw analog data signal by processing the raw analog data signal to obtain an amplitude adjusted analog data signal;

recovering a timing signal from the amplitude adjusted analog data signal;

converting the amplitude adjusted analog data signal to a digital data signal;

processing the digital data signal with a fractionally spaced equalizer to obtain an equalized data signal.

12. A method of reading a multilevel signal from an optical disc as recited in claim 11 wherein the fractionally spaced equalizer is adaptive.

13. A method of reading a multilevel signal from an optical disc as recited in claim 11 wherein the fractionally spaced equalizer is has taps and wherein the fractionally spaced equalizer trains on a training sequence to set the taps.

14. A method of reading a multilevel signal from an optical disc as recited in claim 11 further including processing the equalized data signal using a Viterbi detector to output a recovered data sequence.

15. A method of reading a multilevel signal from an optical disc as recited in claim 14 further wherein the Viterbi detector removes the effect of non data marks from the equalized data signal

16. A method of reading a multilevel signal from an optical disc as recited in claim 11 wherein the equalized data signal is equalized to a target of 1 + D.

17. A method of reading a multilevel signal from an optical disc as recited in claim 11 wherein the equalized data signal is equalized to remove the effects of intersymbol interference.

18. A method of reading a multilevel signal from an optical disc as recited in claim 11 further including decoding the recovered data sequence and detecting errors in the recovered data sequence.

19. A method of reading a multilevel signal from an optical disc as recited in claim 11 further including decoding the recovered data sequence and correcting errors in the recovered data sequence.

20. A method of reading a signal from an optical disc comprising:

reading a raw analog data signal from a disc using an optical detector, the raw analog data signal including an alignment sequence wherein the alignment sequence is chosen such that the autocorrelation of the alignment sequence has a substantially high value at a single alignment point;

converting the raw analog data signal to a digital data signal; and

cross correlating the digital data signal with a stored digital version of the alignment sequence;

whereby the start of a data sequence can be determined.

21. A method of reading a signal from an optical disc as recited in claim 20 wherein the signal is a multilevel signal.

22. A multilevel pattern of marks written to an optical disc including:

a preamble including:

a timing acquisition sequence of fields;

an alignment sequence;

a calibration sequence of marks; and

an equalizer training section; and

a data block.

23. A multilevel pattern of marks written to an optical disc as recited in claim 22 wherein the preamble further includes a data block address.

24. A multilevel pattern of marks written to an optical disc including:

a data block; and

a postamble including:

a dc compensation region that adjusts the overall dc level of the data block and any associated preamble and postamble to substantially zero;

25. A multilevel pattern of marks written to an optical disc as recited in claim 24 including one or more trellis code clean-up marks that returns the trellis encoded data to a known state.

26. A multilevel pattern of marks written to an optical disc organized into an ECC block including:

modulation encoded marks that include encoded data marks; and

physical format marks that include:

periodic ECC data synch fields, periodic timing fields, periodic AGC fields, and periodic DC control fields.

27. A multilevel pattern of marks written to an optical disc organized into an ECC block as recited in claim 26 wherein the modulation encoded marks further include an encoded address section.

28. An ECC block as recited in claim 27 further including one or more trellis code clean-up mark that return the trellis code to a known state.

29. A method of recording data on an optical disc including:

defining a desired data sequence;

deriving a write signal from the desired data sequence using a write strategy;

recording the optical disc using the write signal;

reading the optical disc to obtain a recovered sequence;

comparing the recovered sequence to the desired data sequence;

adjusting the write strategy based on the comparison of the recovered sequence to the desired data sequence so that the recovered sequence tends to converge toward the desired data sequence.

30. A method of recording data on an optical disc including:

defining a desired data sequence;

deriving a write signal from the desired data sequence using a write strategy;

recording the optical disc using the write signal;

reading the optical disc to obtain a recovered sequence;

linearly filtering the desired data sequence;

comparing the recovered sequence to the linearly filtered desired data sequence; and

adjusting the write strategy based on the comparison of the recovered sequence to the linearly filtered desired data sequence so that the recovered sequence tends to converge toward the linearly filtered desired data sequence.

31. A multilevel pattern of marks written to an optical disc including:

data marks that include more than two levels of data;

timing fields occurring periodically between the data marks; and

automatic gain control fields occurring periodically between the data marks wherein the automatic gain control fields correspond to a specific level of data.

32. A multilevel pattern of marks written to an optical disc as recited in claim 31 wherein the specific level of data is a maximum level of data or a minimum level of data.

33. A multilevel pattern of marks written to an optical disc as recited in claim 31 further including dc control fields that maintain a substantially constant dc level when the optical disc is read.

34. A multilevel pattern of marks written to an optical disc as recited in claim 31 wherein the timing fields include data written at a highest level for a consecutive sequence of marks followed by data written at a lowest level for a consecutive sequence of marks.

35. A multilevel pattern of marks written to an optical disc as recited in claim 31 wherein the automatic gain control fields occur periodically among certain timing fields.

36. A multilevel pattern of marks written to an optical disc as recited in claim 31 further including DC control fields corresponding to DC control field output signal levels wherein the output signal levels corresponding to the DC control fields compensate for DC variation in an output signal.

37. A multilevel pattern of marks written to an optical disc as recited in claim 31 further including an alignment sequence of marks.

38. A multilevel pattern of marks written to an optical disc as recited in claim 31 wherein the alignment sequence of marks is a pseudo random sequence that has a response such that if correlated with itself that the correlation gives a high value only at one location.

39. A method of writing a multilevel signal to an optical disc comprising:

encoding data by mapping the data onto a plurality of levels including more than two levels;

adding synchronization fields to the encoded data;

determining a DC level of the encoded data;

adding DC control fields to keep the DC level of the encoded data substantially constant.

40. A method of writing a multilevel signal to an optical disc as recited in claim 39 further including adding automatic gain control fields to the encoded data to provide a predetermined read signal pattern for the purpose of adjusting gain of a read signal.

41. A method of writing a multilevel signal to an optical disc including:

determining a raw data sequence having raw data sequence elements; and

encoding the raw data sequence using a convolutional code to obtain a correlated data sequence wherein the correlated data sequence has correlated data sequence elements that are a function of more than one element of the raw data sequence; and

writing the correlated data sequence to the optical disc.